University of Tripoli - Faculty of Engineering

Department of Electrical and Electronics Engineering

EE302 Signals and Systems - Dr Ali Ganoun 1st Mid-Term Exam Solution

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[2] **Q1**

$$\acute{y}(t) - 2y(t)^2 = x(t)$$

Let the system response to the inputs $x_1(t)$ and $x_2(t)$ be $y_1(t)$ and $y_2(t)$ respectively

$$\frac{dy_1}{dt} - 2y_1(t)^2 = x_1(t) \qquad \frac{dy_2}{dt} - 2y_2(t)^2 = x_2(t)$$

Multiplying the first equation by k_1 and the second equation by k_2 and adding them

$$\frac{d}{dt}[\boldsymbol{k_1}y_1 + \boldsymbol{k_2}y_2] - 2[\boldsymbol{k_1}y_1(t)^2 + \boldsymbol{k_2}y_2(t)^2] = \boldsymbol{k_1}x_1(t) + \boldsymbol{k_2}x_2(t) \qquad \text{--- (1)}$$

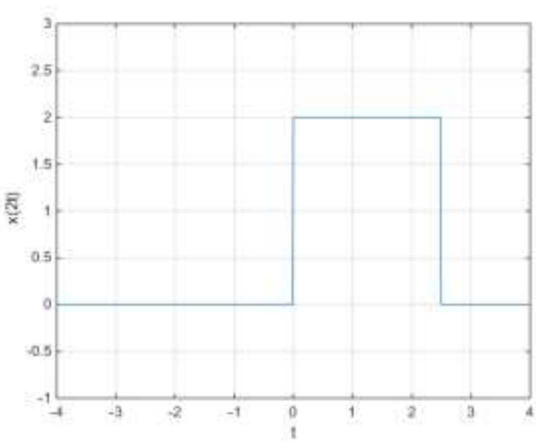
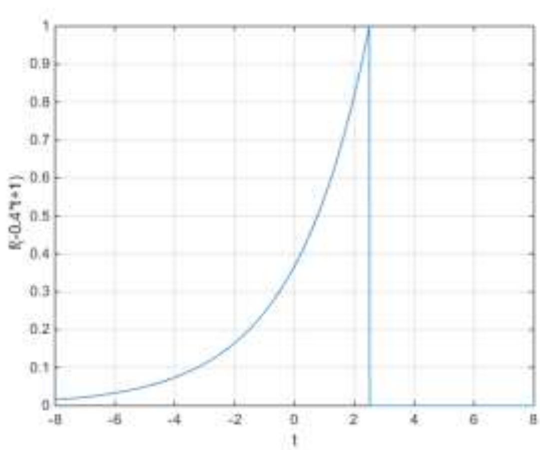
This equation is not equal to the system equation with

$$\boldsymbol{x(t)} = \boldsymbol{k_1}x_1(t) + \boldsymbol{k_2}x_2(t)$$

$$\boldsymbol{y(t)} = \boldsymbol{k_1}y_1(t) + \boldsymbol{k_2}y_2(t)$$

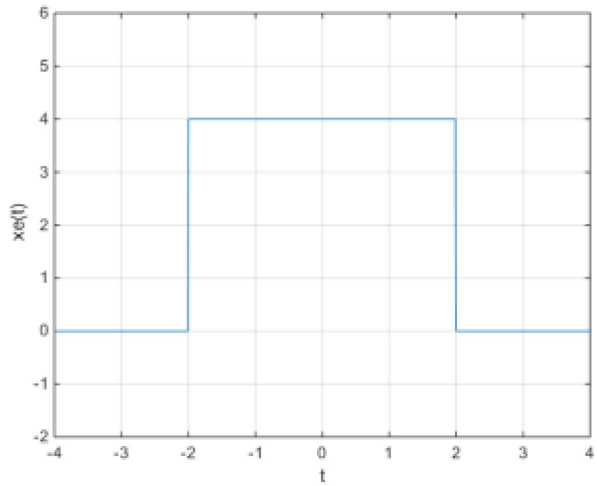
Thus the system is not linear

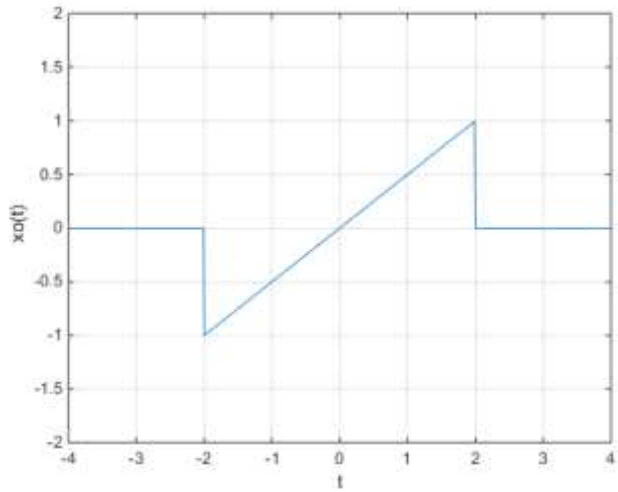
[5] **Q2 –**

$x(t) = 2u(t) - 2u(t-5)$ $y(t) = x(2t) = \begin{cases} 2 & 0 \le 2t \le 5 \\ 0 & o.w. \end{cases}$ $y(t) = \begin{cases} 2 & 0 \le t \le 2.5 \\ 0 & o.w. \end{cases}$	$x(t) = e^{-t}u(t) = \begin{cases} e^{-t} & 0 \le t \le \infty \\ 0 & t < 0 \end{cases}$ $y(t) = x(-0.4t+1)$ $= \begin{cases} e^{0.4t-1} & 0 \le -0.4t+1 \le \infty \\ 0 & -0.4t+1 < 0 \end{cases}$ $y(t) = \begin{cases} e^{0.4t-1} & -\infty \le t \le 2.5 \\ 0 & t > 2.5 \end{cases}$
	

[4] **Q3 –**

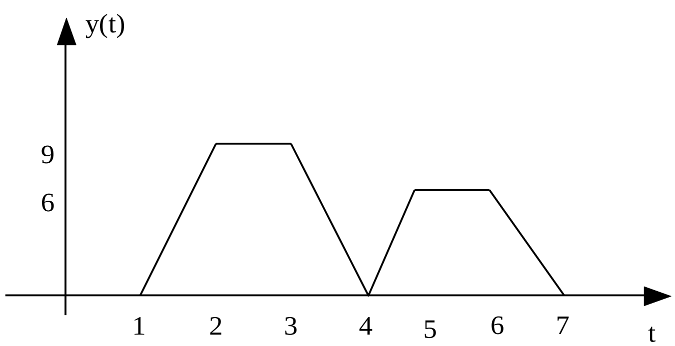
$x_e(t) = \dfrac{(4+0.5t)+(4-0.5t)}{2} = 4$	$x_e(t) = \dfrac{(4+0.5t)-(4-0.5t)}{2} = 0.5t$





[4] **Q4 –**

$$c(t) = x(t) * h(t) = \begin{cases} 0 & t \le 1 \\ 9(t-1) & 1 \le t \le 2 \\ 9 & 2 \le t \le 3 \\ -9(t-4) & 3 \le t \le 4 \\ 6(t-4) & 4 \le t \le 5 \\ 6 & 5 \le t \le 6 \\ -6(t-7) & 6 \le t \le 7 \\ 0 & 7 \le t \end{cases}$$



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